TUESDAY MORNING
Session 12: Urey Prize Lecture
8:30–9:20 (Benton Auditorium)

12.03
Structure and Evolution of Saturn's Rings
L.W. Esposito (LASP and APAS, U. Colorado)

Saturn’s rings show structure at all scales down to the limit of our spatial resolution. Although many of these smaller regions have been called ringlets, this nomenclature implies persistence for these features that is unproven. Dynamic phenomena explain many of the observed features including waves, gaps and ring edges. Much of the small scale structure in the B ring may possibly be explained by a diffusional instability. The local thickness of the rings is measured from observations of waves. This thickness ranges from a monolayer in the inner parts to approximately 30 m in the outer A ring. These differences in thickness and the occurrence of gaps at resonances in the C ring and not in the A ring can be explained by the effect of resonances with Saturn’s moons on an initially very flat ring. Spacecraft observations still allow several possibilities for the origin of the rings. Whatever the origin of the rings, the ring particle system flattens quickly and slowly spreads due to particle interactions. Particles suffer frequent collisions and are probably broken and re-accreted continually. All areas in the rings where collisions are enhanced show smaller average particle sizes. The evolution and sculpting of the rings by resonant interactions has a complementary effect on the small moons, causing them to evolve outward. A major problem is that the time scales for this evolution in orbital radius is much shorter than the age of the solar system.

Session 13: Solar Activity and Coronal Structures
(Room 179)
Display Session

13.02
The Nonlinear Evolution of Solar Filaments in a Sheared Magnetic Field
L. Sparks, G. Van Hoven (U. California/Irvine)

Condensations in the solar corona, known as filaments or prominences, are thought to result from a thermal instability in regions where radiative energy losses are a decreasing function of temperature. To model the formation of filaments in a sheared magnetic field, we have developed a fully vectorized numerical code to integrate in time the compressible magnetohydrodynamic equations in two dimensions. We adopt an energy equation with terms representing adiabatic heating, Joule heating, and radiative cooling. The algorithm uses a leap-frog time-differencing scheme which advances the system explicitly (except for the resistive terms in the induction equation which are treated implicitly using an ADI approach). A coordinate transformation is used to improve resolution across the shear layer. Preliminary results showing the nonlinear behavior of linearly unstable modes are presented.

This research was supported, in part, by the Solar and Heliospheric Physics Branch and by the Solar Terrestrial Theory Program of NASA.

13.04
Resistive Evolution of Coronal Arcades
Z. Mikić, D.G. Barnes, D.D. Schnack (SAIC/la Jolla,Austin), R.S. Steinolfson, T. Tajima (U. Texas/Austin)

We use the recently developed semi-implicit method [1] for the numerical simulation of the resistive evolution of solar arcades, using the three-dimensional, zero-beta, resistive MHD equations. Starting from a potential field, the arcade field is sheared through photospheric motions. Below a critical photospheric flow, a force-free resistive equilibrium is established. Apart from a resistive boundary layer, this equilibrium agrees well with a simple Taylor-state analytical model. When this critical flow is exceeded, the field is linearly unstable on the resistive timescale. This instability deforms the arcade until there is a nonlinear interaction that causes reconnection to occur, resulting in a dynamic disruption of the configuration.


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